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# Smart Teledermatology Platform with AI Enabled Disease Predicting System

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## ABSTRACT

Telehealth is the distribution of health-related services via electronic information and telecommunication technologies. It allows long distance patient and clinician to interact. Telehealth system proposed in this project can be effectively used in diagnosing skin related disease as it is visible through camera. Visual Similarities observed in case of skin diseases such as nevus, seborrheic keratosis and melanoma are difficult to identify. If the people in rural areas are not treated properly then it may lead to cancerous diseases. So, what if a person can get his/her skin related problem diagnosed by visiting the nearby clinic/hospital. To address this problem a teledermatology system is built for proper communication between a primary care clinician in a remote location and a super specialty hospital physician in city for a second opinion. The physician can check the patient's skin disease and identify the disease. This overcomes the distance barriers and improves the health care facility and medical services that would be often not be consistently available in distant rural communities. Also, there is an Artificial Intelligence tool, built to predict the kind of diseases from the live feed of the patient.

**Keywords** – Telehealth, Teledermatology, Artificial Intelligence, Melanoma, Skin disease

## I. INTRODUCTION

Telemedicine has entailed the use of communication, information data, and interactive audio to set up the transfer of medical data, and to facilitate remote patient consultations, diagnosis, and treatment. It permits long-distance patient and practitioner contact, care, advice, reminders, education, intervention, monitoring, and remote admissions [1] , in keeping with the globe Health Organization, a broad definition is "The delivery of health care services, wherever distance could be an important issue, by all health care professionals victimisation data and communication technologies for the exchange of valid data for designation, treatment and interference of unwellness and injuries, analysis and analysis and for the continued education of health care suppliers, beat the interests of advancing the health of people and their communities"[2]. Telemedicine has comprised the use of telemedicine and imaging to deliver remote medical specialty services (clinical and laboratory) to patients situated at a distance it's been one among the foremost quickly evolving branches of telemedicine medicine has been one among the medical specialties wherever telemedicine has been most smartly enforced. The ever-increasing demand for, specialised medical specialty care including the pressing got to boost patient access has placed respectable strains on

medical specialty services [3]. Information concerning Medical Doctor desires assessment have assessed that, for a most of 30,000 people, it ought to be a minimum of one specialist on the market to supply necessary services. However, the present situation has been removed from ideal. The International Foundation for medicine has determined that three billion people residing in 345 developing rural communities have suffered from inadequate medical specialty care [4]. Countries within the developing a part of the globe are facing horrifying shortage in specialists like dermatologists. The stark disparity in density between urban and rural areas has been a regarding issue, with bigger concentration in urban areas even supposing fifty-four of the world-wide population has been settled in urban areas with bigger access to health resources than rural areas, a big portion has still inhabited rural areas with very little access [5]. Given these problems, tele dermatologists have thought that delivering medical specialty care through tele medicine might aid in up access to inhabitants based mostly in rural areas since its edges might be cypher and mobilized to supply very important services remotely to people. Telemedicine could be a success in higher medical specialty care normally and aesthetic care above all. Dermatologists within the peripheral and remote regions got to reach these specialists for the advantage of their patients. On magnified collaboration between dermatologists and first health-care suppliers in rural areas is needed so as to handle high patient demand and to supply support. this method provides A level of communication between the senior physician and also the patient through a primary medical aid practitioner. Telemedicine could be a success in higher medical specialty care normally and aesthetic care above all. Dermatologists within the peripheral and remote regions got to reach these specialists for the advantage of their patients. On magnified collaboration between dermatologists and first health-care suppliers in rural areas is needed so as to handle high patient demand and to supply support. this method provides A level of communication between the senior physician and also the patient through a primary medical aid practitioner.

## II. RELATED WORK

According to Hossain [6] a sensible home health care system might be helpful for aged people who maybe perpetually monitored. The delineate system uses a mix of tools like microphones and video cameras put in homes with the aim of continually capturing pictures and patient speech for period of time observation. All knowledge is hold on during a cloud server

Kroemer et al [7], during a tumour screening context, evaluated the diagnostic accuracy of clinical dermoscopic image tele-evaluation. Over amount of 3 months, they noninheritable pictures from 322 clinical cases and 278 dermoscopic cases employing a portable camera. The authors found that clinical image tele-evaluation can be the tactic of alternative for mobile tumour screening.

Rosado et al [8]. state that "mobile teledermatology may be a promising tool with the potential to empower patients to adopt a full of life role in managing their own health standing." In their work, they gift a mobile- based framework developed to produce Associate in Nursing early designation of skin cancers. The delineate system consists of a mobile application for patients, a server to method and store pictures, and an internet interface for dermatologists.

According to Kanthraj [9], patient-assisted teledermatology follow may be a new model developed within the health-care context. during this model, a patient will transfer his medical knowledge, (i.e., clinical images) as a primary purpose of contact to request a consultation or a face-to-face examination followed by a teledermatology consultation.

Finally, Jaworski et al [10] projected a cloud-based teledermatology system for the quick and economical

exchange of data. The system supports the consultation method between general practitioners and dermatologists, and it may be helpful just in case of inexperienced doctors once the applying is employed as a choice network.

## III. PROPOSED SYSTEM

This research framework illustrates the process of utilizing tele dermatology involves the needs of tele dermatology in rural areas. A health care provider may have difficulty in identifying the type of disease due to the visual similarities between two or more diseases. This could be observed in the case of skin diseases such as nevus, seborrheic keratosis and melanoma since all of them are visually similar. To diagnose such diseases, a variety of visual clues may be used such as the individual morphology, the body site distribution, colour, scaling and arrangement. When the individual elements are analysed separately, the recognition process can be quite complex to be done manually. A telehealth system is built for proper communication between a primary care clinician in a remote location and a super specialty clinician in a sophisticated hospital for second opinion. The methodology used is a systematic review approach. Figure 1 represents the workflow of the proposed approach.

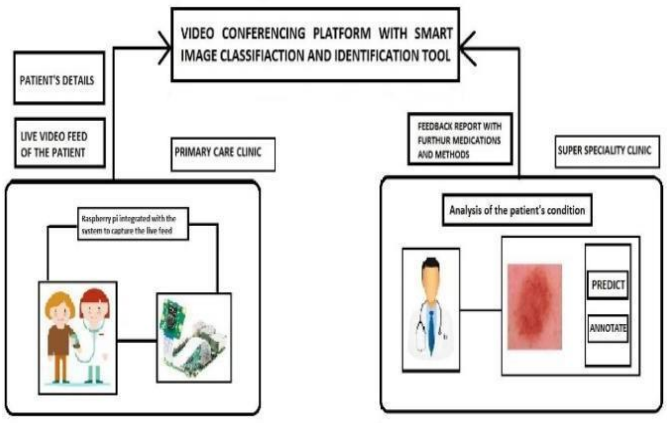


Figure 1: Workflow of proposed approach

The approach is performed in three different stages: (A) Real-time videoconference and communication (B) Smart Identification Tool (C) Smart Image Classification.

### A. REAL-TIME VIDEOCONFERENCE AND COMMUNICATION

Video conferencing is a visual communication session between two or more users regardless of their location, featuring audio and video content transmission in real time. A teleconferencing platform is used to connect a primary care clinician with a senior physician in the city. The interactive video conferencing platform allows the examining physician to interact with both the patient and the remote doctor at the far end. Such direct and two-way interaction allows the doctor to establish a better rapport with the patient, ask further about the patient's medical history, and request certain images of the patient from the remote doctor. Besides the teleconferencing feature, both the physicians can communicate through messages, send and receive files through which a detailed patient's history can be shared with the senior physician. This helps in achieving high levels of physician and patient satisfaction.

### B. SMART IDENTIFICATION TOOL

Raspberry Pi is used as a smart identification tool in this system. It is utilized due to the multi-capacity, efficiency of low power consumption. This device works well as a multi-processor. It is a portable device. The Raspberry pi is connected with a camera through a cable which captures the live video feed of the patient's discoloured skin. This smart identifier is integrated with the teledermatology system on the primary care clinic in the remote area. The senior physician can have a clear observation of the patient's skin and identify the disease easily.

### C. SMART IMAGE CLASSIFICATION

Smart image classification is performed using Machine Learning. A Deep learning model is developed to identify the category of the skin disease. The application is the classification of melanoma and keratosis since it is the most mistaken and wrongly identified skin disorder. The dataset used here is approximately a collection of 13,000 images of Melanoma and Non-Melanoma. The sample images of the dataset is shown in Figure 2 below

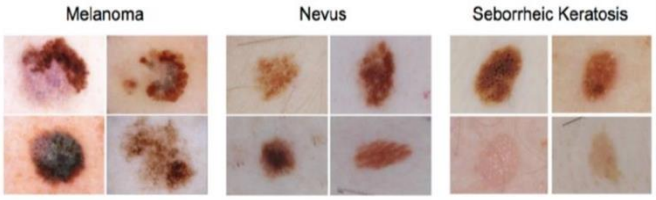


Figure 2: Sample dataset

The dataset is split into 10,000 images for training the model and 3000 images for testing the model. The senior physician identifies the type of skin disease by capturing the live feed of the patient's skin and sending the captured image to the model. The model identifies the type of skin disease. The physician later sends a report to the primary care clinician regarding the skin disease. The remote physician accordingly prescribes medicines and methods for the patient.

## IV. RESULT AND DISCUSSION

The developed teledermatology platform initially has a login page where doctors will enter their credentials which will be stored in the back-end for further use. The Doctor will choose either super specialty clinic or primary clinic according to their role. A unique room-id will be entered by the doctor on both super specialty clinic and primary clinic which will get them connected through the socket. The main page layout of Super Specialty clinician is shown in Figure 3 below

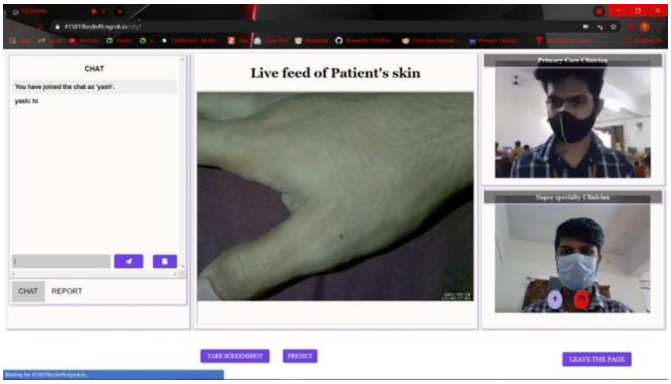


Figure 3: Layout of Super Specialty Clinician

The live feed of the patient's skin from the Raspberry Pi Camera. The video conference that allows the examining physician to interact with both the patient and the primary clinic doctor. Once the End call button is clicked the socket will get disconnected and the streaming video of another person will disappear. Besides teleconference, both physicians can communicate through Chat box, send, and receive files.

The doctor can take a Screenshot of the patient's live feed which will be saved in the local server. Once the View button is clicked the image will appear as a thumbnail at the bottom of the page. A tool button is provided which will open the annotation tab such that the doctor can annotate using tools like freehand, rectangle, and straight line as shown in Figure 4. A clear button is provided to clear the annotations that are made. Once the annotations are done, the doctor can save the image and send it to the primary clinician. Predict button is provided such that once the button is clicked, the image that is saved will be loaded in a Python file and a particular Artificial

Intelligence model is processed in the back-end which will give an output after determining the skin disease in Figure 5.

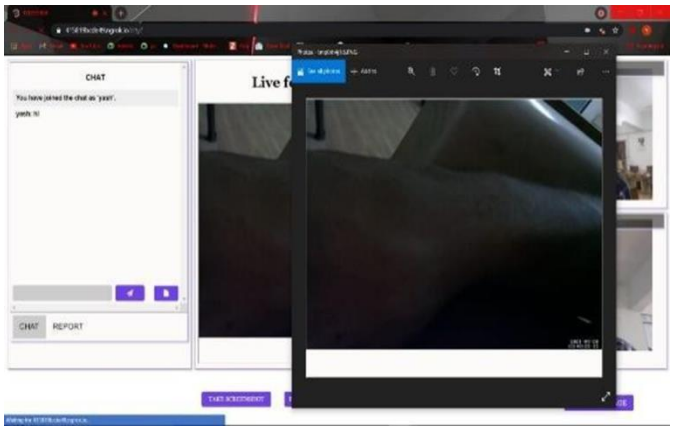

Figure 4: Screenshot

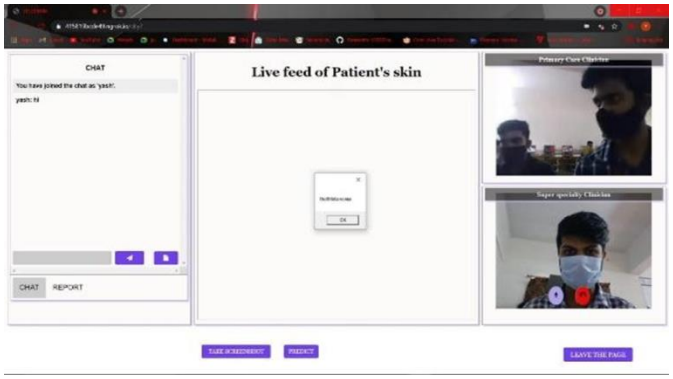


Figure 5: Result Prediction

A Report and a prescription tab are provided such that the doctor can write the report and the prescription of the patient and send it to the primary care clinician once the Super specialty clinician examines the disease. The primary care clinician can print it and provide it to the patient. Figure 6 represents the Report file which is exported to MS word.

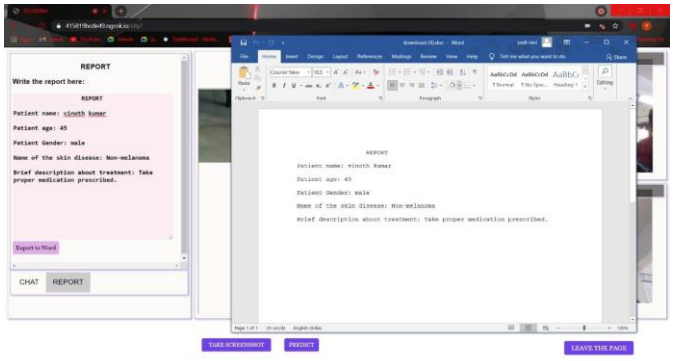

Figure 6: Report File

Super Specialty clinician and Primary clinician can leave the Teledermatology platform by clicking the 'Leave the page' button which will direct them to the End page.

## V. CONCLUSION

The need of dermatologist in rural areas is increasing day by day, but most of the dermatology practice is done with high end equipment in urban areas. So, there is a big gap between the people in rural areas and the doctors in the urban area. In order to build this gap, a video conferencing application has been developed with more features built in. In this project the primary clinician with the patient has connected to our website with login credentials and joined a room with specific room number. Now the super speciality clinician in the urban area also logs in to our website and joins the room using the same room number. There is a chat feature where both the doctors can communicate and send and receive files through chat option. The skin feed of the patient is transmitted with the raspberry pi camera to the server, which is displayed in website, so that the clinician in the urban area can look at the skin feed. The super speciality clinician views the skin of the patient and takes multiple snapshots of the skin and process it with the AI feature in the webpage. After analysing the skin feed and also the AI prediction result, the super speciality clinician comes up with a conclusion and writes a short report of the patient in the tab named report next to chat option, he then exports the result to a word format and sends the report document to the primary clinician via chat option. Finally, as a result of this project, the patient gets the prescription or instructions to be followed, from both the doctors by saving his time and travel cost.

In future, high-definition camera will be incorporated with our system to provide high-definition video streaming for better prediction of diseases using improvised AI algorithms. In addition to the high-definition camera, multiple cameras such as thermal

camera can also be integrated to detect breast cancer and more other varieties illness.

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